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Journal of the American Dental Association, Vol. 152, No. 1 (January 2021): 80-81.e2. [DOI](#). This article is © American Dental Association and permission has been granted for this version to appear in [e-Publications@Marquette](#). American Dental Association does not grant permission for this article to be further copied/distributed or hosted elsewhere without express permission from American Dental Association.

Zirconia restorations: An American Dental Association Clinical Evaluators Panel survey

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Abstract

Background

Zirconia is a relatively new dental material used for indirect dental restorations. Little is known about how dental practitioners are using this material in their practice.

Methods

A survey on zirconia restorations was developed and administered electronically through e-mail communications to the American Dental Association Clinical Evaluators (ACE) Panel on August 31, 2020. Reminders were sent to nonrespondents, and the survey closed 2 weeks after the launch date.

Results

When using zirconia for a restoration, respondents choose it to restore natural teeth (99%) more often than implants (76%). Almost all respondents (98%) use it for posterior crowns, whereas approximately two-thirds (61%) use it for anterior crowns. Restoration removal or replacement and shade matching and translucency were the top 2 cited disadvantages of zirconia, whereas most of the respondents (57%) cited flexural strength or fracture resistance as the biggest advantage. Fine diamonds and ceramic polishers are used most often to polish and adjust zirconia restorations, whereas coarse diamond rotary instruments and those made specifically for zirconia are most frequently used for removing these restorations. Compared with metal ceramic restorations, more than 50% of respondents experience debonding more often with zirconia restorations.

Conclusions

Dentists recognize the favorable fracture resistance and flexural strength properties of zirconia, and most use similar techniques when adjusting and removing this material. Removing these restorations and shade matching are a struggle for many.

Practical Implications

Dentists may benefit from tips on the best methods to remove, shade match, and adhesively bond zirconia restorations.

Survey Results

Data reflect the responses of 277 American Dental Association Clinical Evaluators (ACE) Panel member dentists in the United States.

Zirconia use for abutments*



Layering zirconia with porcelain^{†,§}

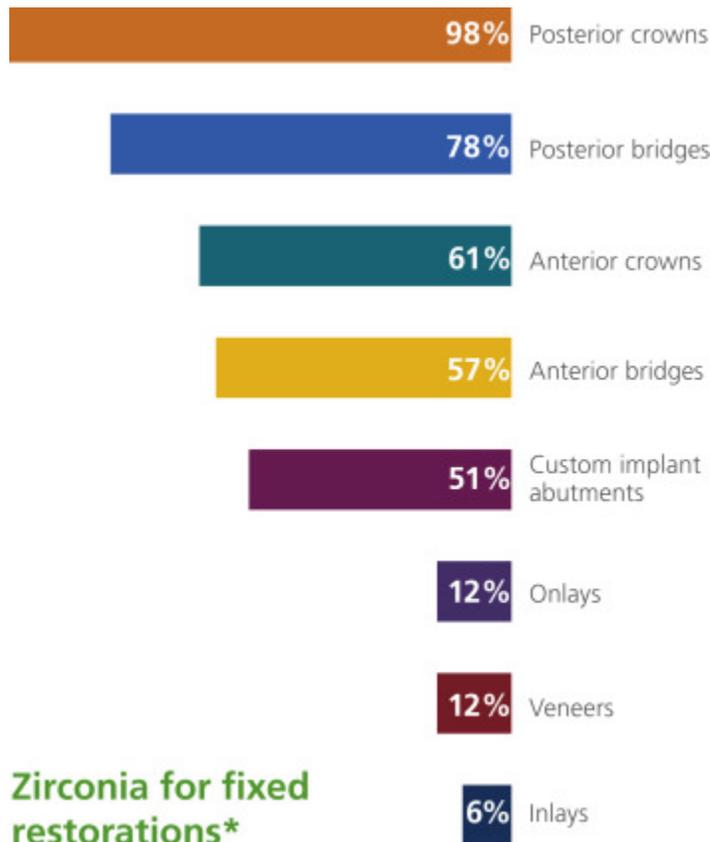


Adjusting and removing zirconia restorations*

Adjustments



Removal



Zirconia for fixed restorations*

Three most common complications with zirconia compared with metal-ceramic restorations*





Demographics (n = 277)

Age, y, Mean (Standard Deviation)	55.0 (14)
Female/Male, %*	23.1/76.9
Region, %[†]	
Northeast	21.1
Midwest	26.1
West	26.4
South	26.4
Race or Ethnicity, %[‡]	
White	78.7
Asian	9.9
Hispanic or Latino	1.5
Black or African American	1.1
Native Hawaiian or other Pacific Islander	0.7
American Indian or Alaskan Native	0.4
Other or multiracial	7.7
Practice Type, %[§]	
General practice	89.8
Specialty	10.2
Occupation, %	
Full-time practice (≥ 30 h/wk)	76.2
Part-time practice (< 30 h/wk)	6.5
Dental school faculty	8.3
Part-time faculty and practice	2.5
Other	6.5

*1 respondent chose not to respond to this question

[†]Geographic region was missing for 16 respondents

[‡]Race or ethnicity was missing for 5 respondents

[§]Practice type was missing for 2 respondents.

Clinical Insights

Zirconia is a ceramic, specifically an oxide of the metallic element zirconium. Original formulations of dental zirconia containing 3 mole% yttria (3Y) or yttrium oxide had high strength and fracture toughness. Newer, more translucent formulations were later introduced containing higher concentrations of yttria (4 mol% yttria [4Y] and 5 mol% yttria [5Y]). Increasing yttria stabilizes the more translucent cubic phase of zirconia.¹ Cubic zirconia is unable to undergo transformation toughening,

and, therefore, the strength and fracture toughness of translucent zirconia (4Y and 5Y) are less than those of original zirconia (3Y).²

Zirconia is milled into oversized restorations from chalklike disks and then sintered into its final form and size in a furnace. Many different brands of zirconia disks are manufactured, which may vary on the basis of the type of raw zirconia powder, the homogeneity of the final product, elimination of porosities, and the recommended sintering programs. All of these factors along with the milling process may affect the strength, translucency, and dimensional accuracy of the final restoration.³

Among a sample of US dental patients, most zirconia restorations were cemented with glass ionomer or resin-modified glass ionomer cements.⁴ Bonding to zirconia with resin cement can produce a higher crown retention.⁵ To bond a zirconia crown, the surface is sandblasted and treated with a 10-methacryloyloxydecyl dihydrogen phosphate–based primer.⁶

Zirconia is stronger than porcelain and does not roughen during tooth wear, and it has been shown to produce less wear to opposing enamel than porcelain.^{7, 8, 9, 10, 11, 12} In addition, polishing zirconia after occlusal adjustment has been shown to decrease opposing enamel wear.¹⁰ When removing crowns, diamond rotary instruments specifically designed for zirconia crown removal are more effective than traditional diamond burs. Accessing through a zirconia crown for endodontic procedures, however, may be achieved more safely with a fine diamond owing to less edge chipping.¹³

American Dental Association Clinical Evaluators Panel Methodology

History of the American Dental Association Clinical Evaluators Panel

The American Dental Association Clinical Evaluators (ACE) Panel¹⁴ was first convened in 2006 as a volunteer group of American Dental Association (ADA) members who provided clinical feedback on professional product evaluations for a professional product evaluation newsletter known as the *ADA Professional Product Review*.

In 2013, the ADA Division of Science received software to conduct its own surveys, and the first professional product review survey was deployed in September 2013 to the ACE Panel and a separate random sample of 3,000 dentists. Since then, ADA Science Institute and, later, ADA Science and Research Institute (SRI) staff members have worked with the ACE Panel Oversight Subcommittee of the Council on Scientific Affairs to generate ACE Panel survey results reports.

As of January 2020, the ACE Panel is used to take the pulse of ADA member perceptions and feedback regarding professional products, materials, and clinical techniques. The ACE Panel comprises 940 ADA members who have the opportunity to participate in quarterly surveys.

Purpose of the American Dental Association Clinical Evaluators Panel

The ACE Panel is a network of practicing ADA members who want to learn from one another by sharing clinical insights and experiences that can help build science content focused on dental materials and clinical-based research. The ACE Panel is a valuable resource in that it enables ADA members to expand their clinical knowledge about dental products, materials, devices, and drugs. In addition, the ACE Panel provides a platform for dentists to expand their professional network of dental experts and

clinical scientists. ACE Panel members also have the opportunity to identify knowledge gaps and areas of future research for the ADA SRI.

Panel Recruitment and Composition

The ADA SRI actively recruits new ACE Panel members through the ADA Meeting, targeted e-mail campaigns, ADA News stories, the ADA Morning Huddle, and science-related ADA continuing education courses for clinicians. Any ADA member can join the ACE Panel by visiting the ACE Panel home page.

Survey Development

A subcommittee of the ADA Council on Scientific Affairs selects topics for each survey on the basis of suggestions from the ACE Panel and ADA SRI priorities. After topic selection, the subcommittee and the ADA staff methodologist (O.U.) develop the survey content in the Qualtrics Research Core platform.¹⁵ When a topic is outside the expertise of the subcommittee, ADA SRI staff members and subcommittee members consult subject matter experts. Before deployment to the ACE Panel, ADA SRI staff members and the subcommittee conduct an iterative process of pretesting the questions with another group of ADA SRI staff members and the subcommittee members to help ensure the comprehensiveness of answer choices, brevity (that is, surveys should take approximately 5 minutes to complete), clarity in question wording, logic, and response options and response scales (for example, Likert scales and numerical rating scales), among other survey methodology best practices. ADA SRI staff members and the subcommittee deploy the surveys to the ACE Panel electronically via e-mail, including a link to access the questionnaire. All links are set to expire 2 weeks after deployment. One week after deployment, ADA SRI staff members and the subcommittee send e-mail reminders to nonrespondents.

Data Analysis and Reporting

After respondents take the survey, they immediately have access to an interim report containing aggregate data from all respondents to that particular point in time. Two weeks after deployment, ADA SRI staff members export the final data set from Qualtrics Research Core platform to a .csv file and import the file into SAS Version 9.4 for data cleaning, relabeling of variables, and conducting exploratory and descriptive analysis (for example, participant demographics [including gender, age, region, race, practice type, and occupation] and means for continuous variables and proportions for discrete variables). These analyses provide insights as to which data will be prioritized for reporting and in which format. Next, in consultation with a graphic designer, ADA SRI staff members develop infographics to illustrate the most relevant results and elaborate clinical insights to facilitate the use and contextualization of the information from the survey. The collection of final reports for ACE Panel surveys are published in *The Journal of the American Dental Association* and are available electronically in the ACE Panel report library.¹⁶

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